June 18, 1940. W. W. CARPENTER ET AL 2,204,957

AUTOMATIC CALL RECORDING SYSTEM

Original Filed Nov. 6, 1937 2 Sheets-Sheet 1

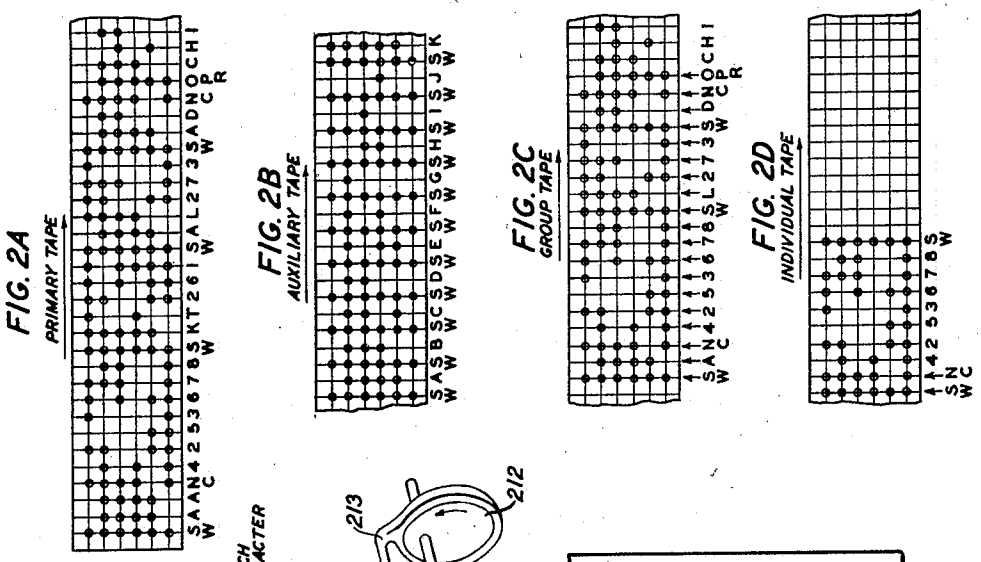


FIG. 1

FIG. 2 FIG. 3

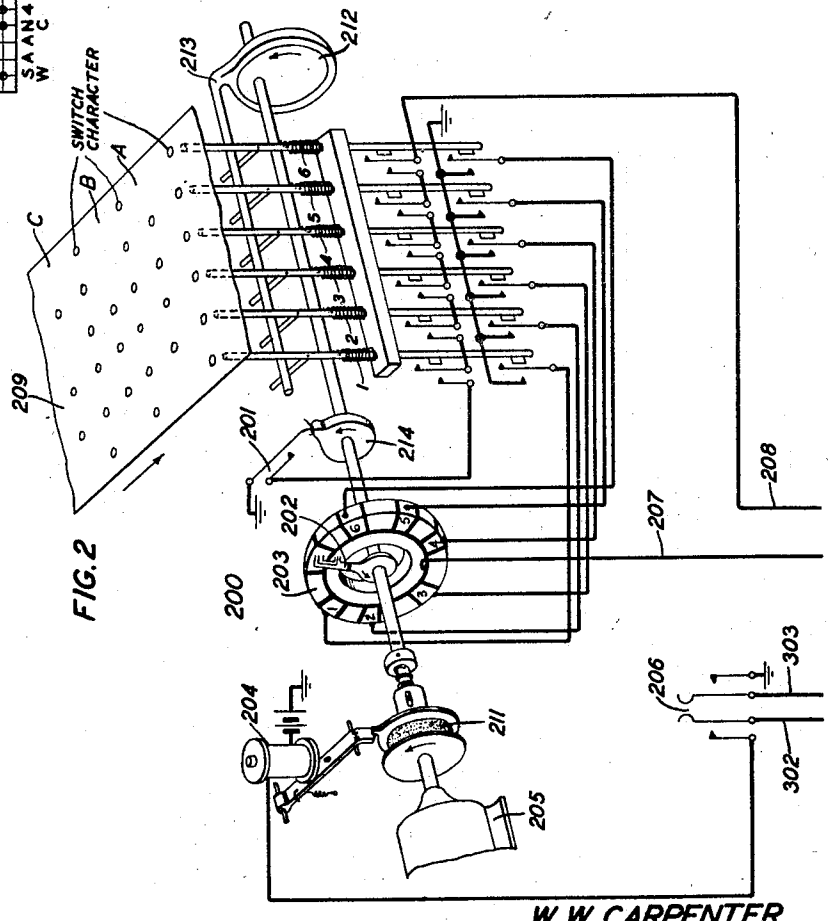


FIG. 2

INVENTORS: W. W. CARPENTER
W. H. MATTHIES
BY P. C. Smith
ATTORNEY

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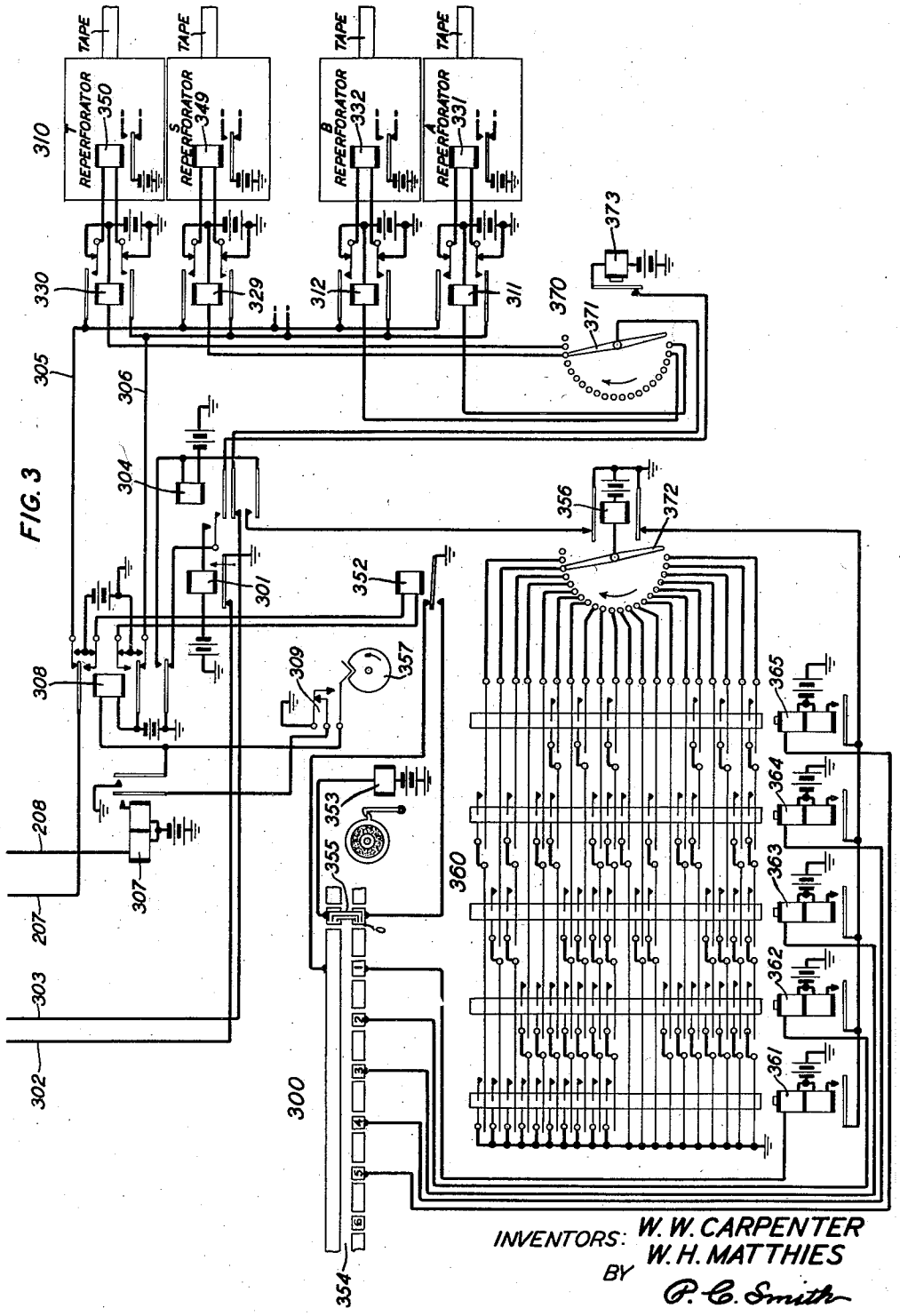


FIG. 3

INVENTORS: W. W. CARPENTER
W. H. MATTHIES
BY P. C. Smith
ATTORNEY

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AUTOMATIC CALL RECORDING SYSTEM

Warren W. Carpenter, Garden City, N. Y., and William H. Matthies, Hackensack, N. J., assignors to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Original application November 6, 1937, Serial No. 173,144. Divided and this application May 25, 1938, Serial No. 209,930

10 Claims. (Cl. 164—115)

This invention relates to telephone systems and more particularly to certain elements of an automatic call recording system which embodies the means and the method whereby the various completed calls chargeable to different lines over a stated billing period are automatically recorded, classified and computed upon records individual to each of the separate lines. Specifically, this application is a division of our Patent 2,112,951 issued on April 5, 1939 and which discloses the entire invention. The present application is more particularly directed to that part of the invention which has to do with the method of and the means for producing a record for each line from a primary record produced for all lines by the equipment shown in said patent. This primary record contains all the necessary entries for call charging purposes such as, for example, the calling and called line numbers and start and finish times of conversations, all of which are entered on said record at the time that the several connections are being established and terminated. The purpose of producing such a record is to utilize it with the means set forth in the present application for producing an individual record for each line in order that this record may then be utilized to produce a translated and computed record for each line by the means disclosed in the above-mentioned application.

In our above-mentioned patent, there is described an organization of circuits and cooperating equipment which is adapted for connection to each line in a group of lines terminating in a telephone exchange of the so-called panel type. This equipment is adapted to produce upon a tape or other impressible medium, a record of each call made by a calling line in the group by means of a tape register common to the group. The record includes an identifying designation of the calling line, the code of the called office, the number of the called subscriber therein and the start and finishing time of the connection. The tape register is used discontinuously by all the lines in the group, to each of which it is temporarily connected whenever the registering and switching equipment operatively associated with the calling line has received one complete item of information incident to the establishment of a connection, as for instance, the called office number, or the starting time of conversation or the finishing time of conversation. Each of these items as well as others is punched in a six-digit code across the tape controlled by the recording equipment. Thereafter the equipment is disconnected from the line and held in readiness for operative association with any other calling line in the group with which switching selectors have been connected for extending the line and in the registers associated therewith some item of billable information has been recorded.

The only exception to this order of recording items of billable information is that which relates to toll calls. In this case the line is, of course, routed through a recording position and the recording operator thereat, instead of making the usual ticket for the call, causes the necessary information to be punched on the recording tape by registering said information upon suitable keys of a teletype transmitter. In this case, however, the city or town to which the call is to be completed as well as the called office code and number therein and the charge for the call in terms of dollars and cents is set up on the keyset and subsequently recorded on the tape.

Thus the primary group tape contains an indiscriminate series of notations belonging to different lines, each notation being a separate and distinct item that relates to a call initiated and perhaps completed from a line in the group. However, due to the fact that the call recording equipment is connected to a calling line only for a period sufficient to record on the tape some one particular item of information relating to the call which is being established, and is then reconnected to some other calling line in the group for the same purpose, the different items perforated in succession in the tape are not necessarily correlated to a call initiated and completed from one line, but are separate and distinct from each other in the sense that they may relate to different calls initiated from different lines in the group. And it is evident that these items, if they are to be of any value in the preparation of a tape individual for each line, must have some discriminating characteristic code before or after each and every one of them which will cause suitably designed equipment to recognize the item that follows the discriminating code in order that it may correlate it to other items for the same call and subsequently correlate all calls to the different lines from which they were made. In accordance with the present invention four codes are used for this purpose, the first a "calling line" code, the second a "new call" character code, the third an "operator" code, and the fourth a "switching character" code. The first two codes are used in the appropriate order and one or more of them are punched on the tape in advance of the item to be recorded. These codes will enable the apparatus that makes up the individual tape

to recognize the calling line to which the item belongs and further determine whether or not the item relates to a new call or is simply another item in a call for which the new call code has already been perforated on the tape. The third or operator's code is used in advance of a complete toll record to indicate that what follows is the entire record of a call established through a toll position, while the fourth, the "switching character" code, is used before and after each item to control the operation of the mechanism which produces the individual tape.

Thus the "primary" tape record which is made for a group of lines contains a series of disconnected code notations relating to calls initiated from these lines. The next step in our invention is to take this tape and produce from it one tape for each line that contains all of the items or notations belonging to the calls made from the line, with the notations arranged sequentially in the order in which they would have been entered on the tape had they been entered chronologically in the normal process of establishing the call without interruption for recording the notations of other calls initiated by other lines in the group. That is to say, the order of the notations for all calls would be as follows: the new call code, the calling line number, the called office and number, the starting time and finishing times of the connection, followed the call code, the calling line number of the succeeding call, the called office and number and the starting and finishing time of the connection. If this next call happens to be a toll call, it would be preceded by the operator code, followed by the code of the city, office and number and the toll charges. Each of these groups of notations would then be preceded and followed by the usual switching character code.

The equipment which produces an individual tape for each line from the primary tape is herein called a tape subdivider and consists of a telegraph distributor of a well-known type, a register and a number of reperforating machines equal to the number of subgroups into which, for convenience, the main group of lines is subdivided. For instance, if, as in the case with line-finder arrangements, all the lines are arranged in main groups of four hundred lines with each main group subdivided into subgroups of twenty lines each, there would be twenty reperforating machines associated with one distributor. Hence, when the primary tape is passed through the distributor, a system of circuits responds to a part of the calling line notation code which identifies the subgroup in which the line belongs to select the particular reperforator assigned to that subgroup. After the selection of the proper reperforator, the primary tape is advanced to succeeding code perforations which include that part of the calling line code that was not used in the selection of the reperforator. Each of these unused portions of the calling line code then causes a series of pulses to be transmitted to the selected reperforator to punch all the item codes therein which come in succession up to, but not including, the identification code of the next calling line. When the primary tape has been advanced to this next calling line code, another reperforator is selected in accordance with the subgroup in which the succeeding line belongs. Of course, if this line belongs to the same subgroup as the preceding line, the same reperforator will be selected, after which the codes of all the succeeding notations will be perforated thereon, preceded, however, by the perforation of that part of the new call code which was not used up to select the proper reperforator. In this manner each subgroup tape record made by the reperforator will be identified, not only with respect to all the lines in the subgroup but also with respect to the particular lines therein to which each group of item notations belongs.

Thus if we assume that a main group of four hundred lines is subdivided into twenty subgroups of twenty lines each and that the primary tape record contains all the code perforations for the calls made from the main group of lines, then by running the primary tape through the subdivider, twenty separate "subgroup" tapes will be made, one for each subgroup, each containing, in chronological order all the notation codes relative to the calls made by each of the lines in the subgroup. It now becomes necessary to break down each subgroup tape into an individual tape for each line. In order to do this, each subgroup tape is run through the subdivider and since, in the line-finder arrangement of lines used to illustrate the application of the invention, the disposition of each line in the subgroup is the same as the disposition of each subgroup with respect to the entire main group, the twenty reperforators of the subdivider may again be used to make one tape for each line in the subgroup from the subgroup tape. Hence as the subgroup tape is passed through the distributor that portion of the calling line code which was repeated on the subgroup tape now causes the selection of the particular reperforator whose numerical, or alphabetical, designation is the same as that of the line within the subgroup itself. When the reperforator is selected, the code notations which follow thereafter on the subgroup tape are then recorded on a third or individual tape; each group of notations, of course, being preceded and followed by the usual switching character code.

Thus from one primary tape record for four hundred lines, four hundred individual tape records are made, one for each line, each containing in chronological order, all the recorded notations for each local and toll call, each group of notations being preceded by the code which denotes whether the call is local or toll, and each notation being preceded and followed by the switching character code.

As said before, the present divisional application is directed specifically to the tape subdivider disclosed in the above-named parent application. For the purpose of completely describing the invention, attention is directed to the following drawings in which:

Figs. 2 and 3 taken together and arranged as shown in Fig. 1 disclose, in schematic fashion, the apparatus and circuit organization of the tape subdivider;

Fig. 2A shows a portion of the primary tape prepared by the equipment shown and described in the patent referred to; while

Figs. 2B and 2C show portions of the auxiliary tape and subgroup tape, the second tape being produced by the tape subdivider from the primary tape.

Fig. 2D shows the individual tape.

The production of the primary tape for the main group of lines has already been briefly described, but reference is made to the above-named patent for a more complete description and more comprehensive understanding of the apparatus that produces it. For the purpose of describing those elements of the invention which

are intended to be covered by the present application, it may be assumed that the primary tape has been produced for a group of four hundred lines and that it contains the perforated codes of each of the separate notations that relate to each of the calls recorded thereon separately at the time a particular function for a particular call is completed by any one of the lines in the group. It now becomes necessary to break down this primary tape into a series of individual tape records, one for each line, and containing thereon all code entries relating to calls completed from the line. Since, for the purpose of illustrating the operation of the invention, it has been assumed that the main group of lines consists of four hundred lines and that this main group is subdivided into twenty subgroups, it is clear that the primary tape will have to be resolved into four hundred separate individual tape records.

In order to do this, use is made of the apparatus and circuit arrangement shown in Figs. 2 and 3, both of which together are termed as the tape subdivider. The equipment of the subdivider consists of a telegraph distributor unit **200** which is capable of responding to tape perforations and further capable of setting up telegraph impulses in response thereto such as are used in printing telegraph systems, a printing distributor **300**, also of the type used in printing telegraph systems, a group of twenty separate reperforators A to T, of a well-known construction, designated **310**, a register circuit **360**, and a switch **370** by means of which a series of connections can be made between the distributor unit **200** and each of the twenty reperforators A to T, inclusive.

The distributor unit **200** and the printing distributor **300** are well-known pieces of telegraph apparatus and are not described herein except in so far as such equipment has been modified for operation with the present invention, while each of the reperforators A to T is similar to the tape perforator **180** in the patent above referred to.

With the above equipment and cooperating circuit arrangement, a subgroup tape for each subgroup of lines can be produced by passing the primary tape through the subdivider once and an individual tape for each line can further be produced by passing each subgroup tape through the subdivider twenty times.

It is necessary to bear clearly in mind that the object in breaking down the one primary tape record into four hundred separate and individual records is to assemble on each of said individual records all the entries pertaining to the calls originated from each of the lines to which each of the separate records belong. By referring to the above-mentioned patent, it will be noted that each entry on the primary tape is preceded by a switching character code, that is, by a six-hole code punched transversely across the tape and designated by S. A portion of the primary tape is also illustrated in Fig. 2A of the present application.

For a purpose to be made clear by the description proceeding hereinafter, before the primary tape is run through the distributor unit **200**, an auxiliary tape, shown in Fig. 2B and containing twenty switching character codes and twenty alphabetical codes from A to T, each switching character being followed by the succeeding one of the twenty alphabetical codes, is run through the distributor ahead of the primary tape. That is, the auxiliary tape is so arranged that the first code is the switching character; the second is the code of the letter A of the line subgroup designation codes, the third is that of the switching character, the fourth the code of the letter B, and so on up to and including the code of the letter T.

As soon as the auxiliary tape is inserted in the tape receiving slot (not shown) of the distributor unit **200** and the unit is made ready for operation by closing the circuit of the motor **205**, a key **206** is operated and a circuit is thereupon closed which extends from ground on the contacts of relay **301**, conductor **302**, left contacts of key **206**, winding of magnet **204**, to grounded battery. Magnet **204** operates and unlatches the clutch plate **211** as a result of which the distributor shaft begins rotating with the motor and the distributor brush **202**, keyed to the shaft, sweeps over the commutator segments of commutator **203** and makes contact with each of the segments. The shaft also carries cams **214** and **212**, the latter having an extension rod **213** for depressing the selecting fingers of the distributor away from the tape **209**. As soon as the auxiliary tape has progressed to the point where the selecting fingers are aligned directly underneath the code holes of the first switching character code, all the fingers pass through them and close the two sets of contacts carried on the lower extremity of each of the finger rods. A contact in each set of the lower pair is connected to a commutator segment which corresponds to the number of the finger, while the mates of said contacts are grounded. That is to say, the normally open contact on the lower contact-set of finger 1 is extended to commutator segment 1, that of finger No. 2 to segment No. 2 and so on up to and including that of finger No. 6 which is extended to segment No. 6.

The upper set of contacts on each of the fingers are connected in a series chain from interrupter contacts **201** over conductor **208** to the left winding of relay **307** for the purpose of operating the relay at the end of one shaft revolution, the contacts of the interrupter **201** being closed at that time.

In the meanwhile, at the time key **206** is operated, ground is connected to conductor **303**, the back contacts of relay **304** to brush **371** of switch **370**. Now switch **370** is a well-known switch structure of the back stroke type and is provided with two brushes, namely, brushes **371** and **372** and two cooperating terminal arcs consisting of twenty-one terminals each. Each of the twenty terminals on the bank which cooperates with brush **371** is extended to the winding of a relay associated with one of the reperforators in the group **310**, terminal No. 1 being connected to the winding of relay **311** of reperforator A, terminal No. 2 to the winding of relay **312** of reperforator B and so on up to and including the twentieth terminal which is connected to the winding of relay **330** associated with the reperforator T. On the other hand, the terminals of the arc which are accessible to brush **372** are extended to the common conductors of the group of relays **361** to **365**, inclusive, said relays comprising the register **360**; the first terminal being connected to the first or lowest conductor and the twentieth to the uppermost. Now, depending upon the terminal to which brush **371** is connected at the time ground is connected to conductor **303** when key **206** is operated, a circuit will be completed to any one of the twenty relays **311** to **330**.

Let it be assumed that the switch brushes are resting on the nineteenth set of terminals at the

time key 206 is operated so that a circuit is completed through the winding of relay 329 to grounded battery. This relay, therefore, operates and by closing its contacts, connects the impulser magnet 349 of reperforator S to the common conductors 305 and 306. Therefore, when all of the selecting fingers of distributor 200 have passed through the six holes on the auxiliary tape which make up the switching character code and the distributor brush 202 is making contact with the blank segment of the commutator, the pulsing relay 349 of reperforator S which, prior to the operation of relay 329, is held normally operated from grounded battery supplied over the normal contacts of relay 329 (as is the case with the pulsing relay in each of the other reperforators) now releases and closes the circuit of the start magnet (not shown) of the reperforator S and causes thereby the rotation of the commutator brush of said reperforator over the associated receiving segments. Since the motor of each of the reperforators is synchronized with motor 205 of the distributor 200 in accordance with standard telegraph practice, the commutator brush of reperforator S will reach its first segment at the time distributor brush 202 reaches segment No. 1. Therefore, a circuit is closed which extends from ground on the lower contacts of selecting finger No. 1, segment 1 of commutator 203, distributor brush 202, inner commutating ring of commutator 203, conductor 207, top back contacts of relay 308, conductor 305, top contacts of relay 329, winding of relay 349 of reperforator S, bottom contacts of relay 329, conductor 306, bottom inner back contacts of relay 308 to grounded battery. So long as the distributor brush 202 remains in contact with segment 1, the commutator brush of the reperforator likewise remains in contact with segment 1 of its commutator, and since the line relay is operated during this time, the front contact of the line relay is extended through the brush and No. 1 segment to close a circuit to the first receiving magnet in the reperforator, the other terminal of said magnet being connected to ground. The receiving magnet operates on the pulse and causes the first tape punch controlled by it to be set for perforating the tape in the well-known manner. When the distributor brush 202 has passed segment 1 and is in contact with the insulating segment No. 2, the circuit of the line relay 349 is opened and the receiving magnet is released. When the commutator brush has advanced to the point where it makes contact with commutating segment No. 2, the commutating brush of reperforator S has also advanced to contacting position with commutating segment No. 2 to which the winding of the second receiving magnet is connected. Hence a circuit is closed which extends from ground on the lower contacts of selecting finger 2 to commutator segment No. 2 of distributor 200 and thence, as previously traced, through the winding of the reperforator line relay 349, reoperating said relay and causing the operation of the second receiving magnet to set the reperforator to punch a hole in the second position of the tape.

In the same manner, as distributor brush 202 sweeps over commutator segments 3, 4, 5 and 6, four other impulses are similarly transmitted to line relay 349 of reperforator S, thereby causing each of the six receiving magnets in said reperforator to operate and punch the switching character code across the tape.

During the time that the distributor brush 202 is in contact with the blank segment between commutating segment No. 6 and commutating segment No. 1, interrupter 201 closes its contacts and causes a circuit to be completed which traces from ground on interrupter contacts, the upper set of contacts on each of the selecting fingers, conductor 208, left winding of relay 307 to grounded battery, operating said relay and causing it to lock over its right winding and inner contacts to the normal contacts of interrupter 309. Relay 307 further closes a circuit which extends from ground on its outer contact, winding of relay 308 to grounded battery. Relay 308 operates and transfers conductors 305 and 306 to a battery and ground supply over its middle contacts to reoperate line relay 349 of reperforator S and thus prevent the reperforator distributor brush from falsely making another revolution during the time that relay 329 is operated. Relay 308 further closes an obvious circuit for relay 304 which operates and locks over its own contacts to ground on the top contacts of relay 356 and opens the circuit of relay 329 which releases and disconnects the pulsing conductors 305 and 306 from the reperforator line relay 349 and supplies local battery and ground to said line relay to maintain its operated position. Relays 307, 308 and 304 are fast operating relays and perform the circuit functions above described before the distributor brush 202 comes to its resting position on the blank segment, at which time the interrupter contacts 201 are opened as is also the operating circuit of relay 307. Relay 307, however, does not release because it is locked over its outer winding to interrupter contacts 309 which are normal at this time. Rod 213 is also depressed at this time to lower the selecting fingers out of the tape holes and permit the tape advancing mechanism (not shown) to advance the auxiliary tape to the next group of perforations.

The auxiliary tape is advanced to the next set of holes which, it will be remembered, are those comprising the code of the letter A. Since nothing has occurred to disturb the circuit of start magnet 204, the brush shaft will now make another revolution and the selecting fingers which are aligned under the holes perforated for the character A, that is fingers 2, 3, 4 and 5, will now pass through these holes and cause the closure of the associated finger contacts.

When relay 308 operated, the circuit which holds the line relay 352 of the distributor 300 energized is opened whereupon this relay releases and completes a circuit for the distributor start magnet 353, which circuit extends from ground over the back contacts of relay 352, segment 0 of the distributor commutator 354, distributor brush 355, winding of start magnet 353 to grounded battery. The magnet operates, unlatches the distributor brush clutch (not shown) and causes said distributor brush to rotate into contact with all commutator segments. The motor driving the brush is, of course, in synchronism with the one driving distributor 200, but segment 0 of commutator 354 is smaller in length than the blank insulating segment of commutator 203 so that distributor brush 355 will reach its commutating segment 1 at the time brush 202 likewise reaches segment 1. Therefore, when the brush 202 makes contact with commutator segment 1 no pulse is transmitted over conductor 206 since the ground connected to segment 1 is controlled by selecting finger 1 which is normal for the code of the letter A. Hence line relay

352 will remain on its back contact during the time that both distributor brushes are on their respective segments 1. When the distributor brush 202 reaches segment 2, however, ground is connected to said segment over the lower contacts of selecting finger 2 so that a circuit is completed which extends from ground over the lower contacts controlled by said finger, commutator segment No. 2, distributor brush 203, commutator ring and conductor 207, top front contacts of relay 308, winding of line relay 352, inner front contacts of relay 308 to grounded battery. Relay 352 operates and closes a circuit which extends from ground over its front contacts, continuous segment of commutator 354, distributor brush 355, segment 2, top winding of relay 362 to grounded battery, operating this relay which then locks in a circuit over its bottom winding and contact to ground on the bottom contacts of relay 356. In the same way, pulses are transmitted when brush 202 is in contact with the third, fourth and fifth segments of commutator 203 causing, respectively, the operation of relays 363, 364 and 365, all of which then lock to ground on the bottom contacts of relay 356. In the meanwhile, when the shaft which carries distributor brush 355 started from its position of rest, interrupter 309 was operated by cam 357 making its contacts and thereby opening the locking circuit of relay 307 which now releases. At the same time, however, an auxiliary locking circuit is closed for relay 308 over the make contacts of this interrupter which does not reclose until the end of the distributor brush cycle, so that even though relay 307 is released, the locking circuit of relay 308 at the outer contacts of relay 307 is replaced by that on the contacts 309 of interrupter 357. At the end of the cycle, interrupter contacts 309 restore to normal, opening the circuit of relay 308 which now releases and restores the permanent energizing circuit for relay 352 which now operates to prevent magnet 353 from reoperating and starting another cycle.

When relay 308 releases, a circuit is closed for relay 301 which extends from grounded battery through its winding, top inner contacts of relay 304 to ground on the bottom outer back contacts of relay 308, operating said relay and opening the circuit of start magnet 204 thereby preventing brush 202 from making another revolution. Distributor brush 202 is held from advancing any further until the brushes of switch 370 have been moved to the No. 1 set of terminals as described hereinafter. Hence as soon as relay 308 releases and relay 301 operates, a circuit is completed which extends from ground on the bottom outer back contact of relay 308, inner contacts of relay 304, interrupter contacts of switch magnet 373, winding of said magnet to grounded battery. Switch magnet 373 now operates and steps brushes 372 and 373 over the successive terminals on their respective arcs until brush 372 reaches a terminal which has been grounded by the combination of relays 361 to 365, inclusive, operated in accordance with the code of the perforated character that succeeds the switching character which, in the case under illustration, is assumed to be that of the letter A and resulted in the operation of relays 362 to 365, inclusive. Hence a circuit is established extending from ground over the lowest contact sets of relays 362, 363, 364 and 365, respectively, the No. 1 terminal on the arc accessible to brush 372, brush 372, winding of relay 356 to grounded battery. Relay 356 operates, opens its contacts, releases the register relays 362 to 365, inclusive, and further releases relay 304, which, on releasing, opens the circuit of switch magnet 373 causing the latter to stop, releases relay 301 which reestablishes the circuit to the start magnet 204 of distributor 200. With the release of relay 304 a circuit is completed which extends from ground on the right contacts of key 206, conductor 303, back contacts of relay 304, brush 371, the No. 1 terminal on the arc accessible thereto, winding of relay 311 to grounded battery. Relay 311 operates, opens the operating circuit of line relay 331 of reperforator A and connects the winding of said relay to conductors 305 and 306. With relay 308 released, conductor 305 is connected to conductor 207 over the top back contacts of relay 308 while conductor 306 is connected to grounded battery over the inner bottom back contacts of relay 308. With line relay 311 of reperforator A released, the circuit of the associated reperforator start magnet is closed.

It will be observed that the first switching character code ahead of the first letter code was perforated on the tape associated with any one of the twenty reperforators on the terminal of whose switching relay brush 331 was connected, and that the code of the letter A following the switching character code causes the selection of reperforator A. The auxiliary tape is now advanced to the next switching character code perforations which are interposed between the code of the previous letter character A and the code of the succeeding letter B. Therefore, upon the third revolution of distributor brush 202, that is, when the selecting fingers have passed through the holes making up the code of the switching character code, the six pulses generated by the connection of ground to the six commutator segments of commutator 203 are transmitted over conductor 207 and top contacts of relay 308 to the line relay 331 of reperforator A, thereby causing a perforation of the switching character code on the tape associated with said perforator in the manner already described for the perforation of the switching character on the tape of reperforator S.

At the end of the distributor brush cycle, interrupter 201 again makes its contacts and closes the previously described circuit of relay 307. At the same time, the tape is advanced one notch to the position where the selecting fingers can pass through the tape holes of the next code which follows the switching character code, that is, the holes of the code of the letter B in positions 2, 3 and 4 of the tape. The operation of the circuit now continues as before with the result that relays 362, 363 and 364 are operated and locked in the same manner as relays 362, 363, 364 and 365 were previously operated and locked for the code of the letter A. Switch 370 is now caused to take another step since the terminal on the arc of brush 372, grounded for the letter B, is the one immediately succeeding that for the letter A. The advance of brush 372 to the terminal grounded by the operation of relays 362, 363 and 364 causes the operation of relay 365 and the succeeding operations following thereafter, as already described, whereby reperforator A is disconnected and reperforator B is connected to the pulsing conductors. The tape is next advanced to the next group of holes where the selecting fingers pass through the six holes of the switching character code. The previous operations are

now repeated and the switching character code is perforated on the tape associated with reperforator B. In this manner, a switching character code is perforated as the first entry on each of the tapes associated with each of the twenty reperforators A to T, inclusive, except that the tape of the reperforator to which the distributor 200 was first connected as, for instance, perforator S, will have two switching character codes perforated in succession thereon. However, the entry of two successive switching characters between which no letter code entry is perforated will in no wise influence the proper operation of the circuit.

After the auxiliary tape has been completely run through the subdivider and a switching character code has been perforated thereby on each of the tapes associated with each of the twenty reperforators, the primary tape is run through the distributor unit 200 for the purpose of making twenty separate group tapes, one for each subgroup of lines, on each of which will be perforated the entries of all calls originated from the lines within the subgroup.

By referring to the above-mentioned patent, it will be seen that all code entries on the primary tape which relate to a call are preceded by the code of the switching character and the codes of the two letters which identify the subgroup of the calling line and the line itself, except that preceding the first entry and immediately following the switching character code there is further perforated a "new call" code or the "operator's" code, whichever the case may be. Following these entries is the code of the particular item relating either to the series of codes making up the called subscriber's number or toll call information or the code which indicates the starting time or the finishing time of a local connection. In any event there are at least four entries upon the primary tape which are made in advance of an entry that relates to the details of a call, namely, the switching character code SW, the code of the group letter, the code of the subscriber's identifying letter (AA, etc.) and the new call code NC. Hence when the primary tape is inserted into the tape slot of the distributor unit 200, the first group of holes to become aligned with the selecting fingers will be that of the switching character code which, in accordance with the operations previously described with relation to the auxiliary tape, causes a switching character code to be perforated as an entry on the tape associated with the last reperforator on which the brushes of switch 370 were left standing, that is, on the tape of reperforator T. Therefore, before any call entry is made on any group tape, there will be two tapes having two switching characters recorded thereon. In the case we are considering, these two tapes are those associated with reperforators S and T.

The first entry after the switching character is, as already mentioned, the code of the letter which indicates the subgroup in which the calling line belongs. Since, according to the above-mentioned patent, there are twenty subgroups with each subgroup by some letter from A to T, inclusive, that character may be any one of these twenty letters depending upon the subgroup in which the line making the call belongs and to which call the succeeding entry appertains. Therefore, when the primary tape has been advanced to the point where the selecting fingers are aligned under the holes of the code of the subgroup letter, switch 370 is caused to advance its brushes, in the manner already described, to select the reperforator marked by the operated combination of relays 361 to 365, inclusive, responding to the letter code impulses received by distributor 300. The reperforator switching relay in the group of relays 311 to 330, inclusive, then operates to connect the associated reperforator with the pulsing conductors 305 and 306. The tape is then advanced to the next entry which, in this case, is the code of the letter which marks the position of the calling line within the subgroup itself, and the code of this letter is now perforated on the tape associated with the reperforator whose switching relay has been operated. If, for instance, the calling line is in the nineteenth subgroup and marked by the letter S, relay 329 will be operated, and the code of this letter will then be perforated on the tape associated with reperforator S, this entry following the entry of the last switching character code previously made by running the auxiliary tape through the distributor unit 200. If, on the other hand, the line is in the first or A subgroup, switching relay 311 will have been operated and the pulsing conductors 305 and 306 will be connected to the line relay 331 of reperforator A. Furthermore, if the numerical designation of the line within the subgroup itself is 101, the letter designation of the line would still be A, in which event the complete calling line designation would be AA and the code of the letter A would be punched on reperforator A.

The primary tape is now advanced to the next entry which may be either the new call code or, if it is an entry relating to a call for which other entries have already been made, may be a series of entries either appertaining to the starting time or the finishing time of a connection. If the entry is the new call code, then the entries which follow it are those of the called subscriber's number or the "operator" code. For simplicity of illustration, it will be assumed that the next entry is the new call code which is later followed by the entries of the called office and number. Since, therefore, relay 311 is operated and remains operated, eight pulse groups will be transmitted from the distributor unit 200 over conductors 207 and 305 through the winding of relay 331, conductor 306 to grounded battery, the first of which will be that of the new call code and the remaining seven will be those of the called office and number. The line relay 331 will respond to the pulses and, with each distributor cycle of the reperforator, will cause the code represented by the pulse combination received during the cycle to be perforated on the group tape. If we further assume the called subscriber's number of the call originated by line AA to be Halifax (425) 3678, the subgroup tape of reperforator A will then have recorded thereon in succession: (1) one switching character code; (2) the code of the letter A; (3) the new call code; (4) the three digits of the called office and (5) the four digits of the called number. When all these entries have been made on the subgroup tape, the primary tape is advanced to the next switching character code.

In response to this next switching character code relay 307 is operated, the reperforator A is disconnected from the pulsing conductor 207 and the register 360 is prepared to take the setting of the subgroup character of the line which has made the succeeding group of entries on the primary tape, whereupon switch 370 is stepped to select the reperforator called for by the oper-

ated combination of relays in the register 360. It will be assumed that this code is for a call from a line in subgroup K.

The succeeding code character on the primary tape is assumed to be one marking the calling line T within subgroup K and the code of the letter T is, herefore, punched upon the group tape associated with the reperforator K (not shown), selected in accordance with the code of the letter K preceding the one now being considered. Following the perforation of the code of the line letter, the primary tape is advanced and the pulses of the code pertaining to whatever entry follows thereafter are transmitted. The next entry on the primary tape may be the new call code followed by a series of entries which identify the called subscriber's line, or again, it may be an entry indicating the start of conversation time, or again, it may be an entry relating to the finish of a conversation. As illustrated in Fig. 2A, the three entries on the primary tape following the entry for the code letter T are assumed to indicate the codes for the starting time of a conversation between the line identified by the preceding code letters K and T and a line called thereby. After the pulses have been transmitted in accordance with these entries the primary tape is advanced to the next switching character code which, of course, is perforated on the same group tape, after which the pulsing conductors are switched again to any other reperforator called for by the code character of the next line subgroup. In this way all entries relating to calls originated by the different lines in each subgroup are assembled on one tape for each subgroup, one such representative subgroup tape taking on the appearance shown in Fig. 2C.

Each of the subgroup tapes contains, therefore, code entries of the calling line letter, new call codes, codes of called subscribers' numbers, start and finishing times of connections, offices in different cities and called numbers therein, and also the actual toll charge in money units for any particular toll or long distance connection, as more particularly described in the patent referred to. Each of these entries, or group of entries is, of course, both preceded and followed by the switching character code. For a new local call, the first entry following the line designation will be the new call code while for a toll or long distance connection it will be that of the new call designation followed by the operator's code. Each of the subgroup tapes made by the twenty separate reperforators is marked in any suitable manner to distinguish them from each other.

The next step in the process of making an individual tape for each line is to take each subgroup tape and run it through the subdivider. Bearing in mind that the group tape contains all entries for the twenty lines of a subgroup and also the calling line letter of each line making a call therein, it is clear from the operations of the subdivider already described that the first switching character code appearing at the head of the individual tape will be perforated on the tape of the reperforator to which the brushes of switch 370 are connected at the time pulsing operations begin. The next entry on the subgroup tape is the code of the letter of the calling line. This code causes the relays of register 360 to operate in the appropriate combination, the effect of which is to cause the selection of the similarly lettered reperforator, after which the new call code (if there is one), the call entries and the switching character code are perforated on the tape in succession, one after the other, in the same order as they appeared on the subgroup tape. The next entry following the switching character code will be the letter code of another line in the same group or the same line just considered. If it is the same line, register 360 will be reset in the same way and switch 370 will not move. The entries following thereafter will be perforated in succession on the same tape after the switching character and in the same order as they appear on the subgroup tape. If it is a different line, then the code of that line will set the register 360 accordingly and switch 370 will select the reperforator called for by the line code, after which it will record the succeeding entries and the following switching character code; the operation continuing until the entire secondary tape has passed through the subdivided and the separate entries distributed among the twenty tapes of the twenty reperforators A to T, inclusive.

Thus all the entries on the subgroup tape except the line entries, are distributed among twenty separate and individual tapes, each of said individual tapes containing all the entries relating to a particular line and in the order in which such entries succeed one another for any particular call, each complete entry being followed by a switching character code. In other words, not only are all the entries for one line now entered on a tape individual to that line, but, of necessity, all entries relating to one call are assembled together in the sequence called for by the process of setting up and completing that particular call itself although each complete entry is separated from the next complete entry by the switching character code, the last entry on the tape not being followed by the switching character. Each of these individual tapes is then used to operate the computing equipment described in the parent application.

What is claimed is:

1. In a telephone system adapted for automatic call recording in which means are provided for making a tape record for a group of telephone lines containing notations thereon which relate to calls completed from said lines, a tape subdivider comprising means responsive to said notations for producing a plurality of punched tape records, each individual to a line and containing thereon all the notations for all calls completed from said line.

2. In a telephone system adapted for automatic call recording in which means are provided for producing a tape record for a group of telephone lines containing thereon notations designating the various lines, said notations followed by other notations relating to calls completed from said lines, a tape subdivider for producing a plurality of punched tape records, each individual to a line, said tape subdivider comprising means responsive to the notations which designate the various lines, and other means responsive to said means for producing a punched tape for each line, said tape containing the notations relating to the calls completed from said line.

3. In a telephone system adapted for automatic call recording in which means are provided for producing a primary tape for a group of telephone lines divided into a plurality of subgroups each of which contains as many lines as there are subgroups and in which said primary tape contains notations relating to calls completed from said lines and other notations de-

noting the subgroup, a tape subdivider for producing a subgroup tape for each subgroup of lines comprising a number of perforators equal to the number of subgroups, said perforators being equipped with recording tapes, an impulse transmitter responsive to said notations to produce code pulses designating said notations, a selector register for connecting said transmitter with any one of said perforators, means in said selector register responsive to notations denoting the subgroups for causing said register to select the perforator assigned to said subgroup, and means in said selected perforator responsive to pulses designating said other notations for recording said other notations on the tape associated with said selected perforator.

4. In a telephone system adapted for automatic call recording in which means are provided for producing a primary tape for a group of telephone lines divided into a plurality of subgroups each of which contains as many lines as there are subgroups and in which said primary tape contains notations denoting the subgroups and the disposition of said lines within their respective subgroups and other notations relating to calls completed from said lines, a tape subdivider comprising a number of perforators equal to the number of subgroups, said perforators being equipped with recording tapes, an impulse transmitter responsive to said notations to produce code pulses designating said notations, a selector register for connecting said transmitter with any one of said perforators, means in said selector register responsive to notations denoting the subgroups for causing said selector register to select the perforator assigned to said subgroup, and means in said selected perforator responsive to pulses designating said other notations for recording said other notations in the tape associated with said perforator, said tape so produced by the selected perforator being reapplicable to said tape subdivider to operate said selector register to respond to the notations designating the various lines in the subgroup to reselect the various perforators to produce a tape for each line having thereon the notations of all calls completed from said lines.

5. A tape subdivider comprising an impulse transmitter, a transmission line, a selector register and a plurality of impulse receivers operably connectable to said line, means in said transmitter responsive to code perforations of one of a series of codes on a tape for sending pulses over said line equal to the number of code perforations, means in said selector register responsive to said pulses for operating said register to select one of said impulse receivers and to connect the one selected to said transmission line, and means in said selected receiver responsive to the pulses of other code perforations transmitted over said transmission line for recording said received pulses.

6. In a telephone system adapted for automatic call recording having a main group of telephone lines divided into a plurality of subgroups in which means are provided for making a primary tape record for said main group of lines containing notations relating to calls completed from said lines, notations indicating the subgroups in which the calling lines belong and other notations indicating the disposition of said calling lines within their respective subgroups, a tape subdivider comprising as many perforators as there are subgroups, means responsive to said subgroup notations for selecting each of said perforators as called for by said subgroup notations, and means responsive to said other notations in said tape record for operating the selected perforator to reproduce on another tape the notations of the primary record which follow the group notation.

7. In a telephone system adapted for call recording in which means are provided for producing a primary tape for a group of lines divided into a plurality of subgroups each of which contains as many lines as there are subgroups and in which said primary tape contains notations denoting the subgroups followed by other notations denoting the disposition of said lines within their respective subgroups, said last notations being followed by other notations relating to calls completed from said lines, the method whereby an individual tape is produced for each line which consists of producing a subgroup tape for each subgroup and containing thereon the notation of each calling line in the subgroup followed by the notations relating to a call made from said line, and then producing from said subgroup tape an individual tape for each line in the group which contains the notations of each call made from said line.

8. A tape subdividing mechanism for producing a plurality of punched tape records from one main tape record containing a plurality of code holes, which comprises means responsive to some of the code holes in the main tape record for producing said plurality of other records, each of said other records containing correlated code holes present in said main tape record.

9. In a telephone system adapted for automatic recording in which means are provided for making a tape record for a group of telephone lines containing notations thereon, a tape subdivider comprising means responsive to said notations for producing a plurality of punched tape records, each individual to a telephone line and containing thereon all the notations relating to said line.

10. In a telephone system adapted for automatic recording in which means are provided for producing a tape record for a group of telephone lines containing thereon notations designating the various telephone lines, said notations followed by other notations, a tape subdivider for producing a plurality of punched records, each individual to a line, said tape subdivider comprising means responsive to the notations which designate the various telephone lines, and other means responsive to said means for producing a punched tape for each telephone line, said tape containing all the notations apertaining to said line.

WARREN W. CARPENTER.
WILLIAM H. MATTHIES.